



Sol-Char: Producing Char from Waste using Solar Energy

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Patent pending;
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exclusive or non-
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Background

There are many venues that require toilets, yet a ready supply of running water and sewage treatment facilities are unavailable or very expensive. In such venues, supplying sanitation facilities can be difficult if not impossible. National parks, coastal communities, and drought-prone areas are just a few examples of locations where it is difficult to supply and service toilets. Recreational vehicles, and homes located “off-grid” are other examples of end-users that would benefit from a low-maintenance toilet. This problem is not new, but no significant technological advances in sanitation have occurred since the invention of the flush toilet over 200 years ago. Today’s emphasis on the environmental impacts of human activity, as well as the increasing threat of drought in many areas of the world, call for a reevaluation of off-grid, low-impact toilet technology.

A recent “Reinvent the Toilet Challenge” put forth by the Bill & Melinda Gates Foundation called for researchers to develop sanitation solutions that are affordable and desirable to use, render fecal waste harmless within a short time-span, are self-contained without the need for flush water or electricity, and produce valuable end products. Current waterless toilets – such as dry pit latrines, ventilated improved pit (VIP) latrines, and composting toilets – fall short of these ideals. Dry pit latrines and VIPs are plagued with difficulties associated with the removal of contents from full pits, and the need to treat the waste off-site once it is removed poses additional risks to public health and the environment. Composting toilets require an external power source or intensive user input in order to properly maintain the compost, are often associated with undesirable odors, and require extended lengths of time before the waste is rendered safe and suitable for use as a soil amendment in agriculture.

Technology

A University of Colorado research group led by Alan Weimer has taken on the challenge of “Reinventing the Toilet.” In September of 2012, this group (with Principal Investigator Karl Linden) received funding from the Bill & Melinda Gates Foundation to develop a novel toilet that produces char from waste using solar energy. This toilet, the Sol-Char, is a waterless, self-contained toilet that can function completely off-the-grid by capturing readily available solar energy. Concentrated sunlight is delivered to fiber optic bundles located at the focus of parabolic concentrators; the fiber optic cables are fed to the reaction compartment of the Sol-Char where the various individual cables are terminated at an outer or “solar” lid positioned over the waste collection container. The innovative transmission of solar power illuminates the inner collection container and disinfects the waste through convection and radiation heat transfer. The reaction compartment comprises two containers that are alternated between “collection” and “reaction” modes via a simple carousel system that can be automated (powered with photovoltaic energy) or manually controlled. The reactor is designed to achieve high temperatures with minimal heat loss due to specially designed insulation and produces a safe and useable product. The Sol-Char toilet can be developed for virtually any number of users with solar power input scaled accordingly. Means for innovative odor control and final product storage/collection (for later use as a soil amendment) are also being developed as a part of the Sol-Char.



Key Documents

“Thermal Treatment System and Method.” U.S. regular application filed March 15, 2013; available under CDA.

[Solar-driven thermal toilet with biochar production \(video\)](#). Presented at the Second International Conference on Faecal Sludge Management (FSM2), October 2012, Durban, South Africa. PDF available upon request.